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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/241,851	02/02/1999	TAKEHIKO NAKAI	865.4335	9228

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EXAMINER

CHANG, AUDREY Y

ART UNIT PAPER NUMBER

2872

DATE MAILED: 05/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.	Applicant(s)	
	09/241,851	NAKAI, TAKEHIKO	
	Examiner	Art Unit	
	Audrey Y. Chang	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,5,9 and 12-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,5,9,12-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on **March 16, 2004** has been entered.
2. This Office Action is also in response to applicant's amendment filed on March 16, 2004.
3. By this amendment, the applicant has amended claims 1-2, 4-5, 9, 12, and 20-22 and has canceled claim 11.
4. Claims 1-2, 4-5, 9, and 12-22 remain pending in this application.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1, 12, 13-17 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Ishii (PN. 6,157, 488) in view of the patent issued to Gerritsen et al (PN. 5,048,925).

Ishii teaches a *diffractive optical element* that is comprised of a *diffractive portion* having a *pair of diffractive gratings* (11 and 13, Figure 6, 14 and 16, Figure 7, or 101 and 103 Figure 8), wherein the pair of diffractive gratings are made of *materials with different dispersion properties*, (please see explicitly for the grating materials recited in column 13 lines 36-42). Ishii teaches that the pair of

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diffractive gratings each has a *thickness* of d_1 and d_2 , wherein the *thickness* can be *different*. Ishii teaches explicitly that the *ratio of the grating thickness* is measured by α wherein it can assume both value one and not equal to one, (please see column 9, lines 35 and 60-67). In Figure 11, Ishii specifically teaches that the pair of diffractive gratings can be designed to have different thickness (d_1 and d_2) and the pair of diffractive gratings achieves maximum diffraction efficiency of a diffraction order ($m=1$) for a *range of wavelengths* that certainly include two or more wavelengths. This suggests by the *diffraction theory* the maximum path length difference is an *integer* multiple of more than two wavelengths in the range for the same integer or the same diffraction order. This means that the maximum path length difference determines if the diffractive optical element would diffract light having particular wavelengths at certain diffraction order. If the diffraction efficiency is at 100% for a diffraction order of certain wavelength, the maximum path length difference is equal to the diffraction order times the wavelength.

This reference has met all the limitations of the claims. Ishii also teaches that the pair of diffractive gratings is formed to confront each other with a *spacer* layer (12, 15 or 102) in between. However this reference does not teach explicitly that the spacer layer has a refractive index of 1. But using air (refractive index equals one) as spacer layer for separating a pair of diffractive gratings is rather well known in the art. Gerritsen et al in the same field of endeavor teaches to use an air gap as the spacer layer interposed between a pair of diffractive gratings. It would have been obvious to one skilled in the art to apply the teachings of Gerritsen et al to use air gap layer as an alternative material for making the diffractive optical element for the benefit of providing an alternative design for the element. It also has been held it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

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With regard to claim 12, Ishii teaches that the diffractive gratings have blaze type relief patterns.

With regard to claim 13, Ishii teaches that the diffractive optical element (41) may be used with a lens (51) within an image pick-up system (60), (please see Figure 22).

With regard to claims 15-16, Ishii teaches that the optical regions may include optical material such as ultraviolet curable resin, (please see column 13, line 40). Although this reference does not teach explicitly that each pair of the diffractive gratings are made of such resin however it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With regard to claims 20-22, Ishii teaches the diffractive optical element is a diffractive lens that may assume conventional lens form (Figure 30) which means the diffractive optical element is formed on a lens.

7. **Claims 2, 4, 5, 9, and 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patents issued to Ishii and Gerritsen et al in view of the patent issued to Sakai et al.**

Ishii teaches a *diffractive optical element* that is comprised of a *diffractive portion* having a *pair of diffractive gratings* (11 and 13, Figure 6, 14 and 16, Figure 7, or 101 and 103 Figure 8), wherein the pair of diffractive gratings are made of materials with *different dispersion properties*, (please see explicitly for the grating materials recited in column 13 lines 36-42). Ishii teaches that the pair of diffractive gratings each has a *thickness* of d_1 and d_2 , wherein the thickness can be different. Ishii teaches explicitly that the *ratio* of the grating thickness is measured by α wherein it can assume both value one and not equal to one, (please see column 9, line 35 and 60-67). In Figure 11, Ishii specifically teaches that the pair of diffractive gratings can be designed to have different thickness (d_1 and d_2) and the pair of diffractive gratings achieves *maximum* diffraction efficiency for certain diffraction order ($m=1$) at *a range of wavelengths* that certainly include two or more wavelengths. This suggests by the diffraction

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theory the *maximum* path length difference is an integer multiple of more than two wavelengths in that range for the same integer or the same diffraction order. This means that the maximum path length difference determines if the diffractive optical element would diffract light having particular wavelengths at certain diffraction order. If the diffraction efficiency is at 100% for a diffraction order of certain wavelength, the maximum path length difference is equal to the diffraction order times the wavelength.

This reference has met all the limitations of the claims. Ishii also teaches that the pair of diffractive gratings are formed to confront each other with a spacer layer (12, 15 or 102) in between. However this reference does not teach explicitly that the spacer layer has a refractive index of 1. But using air as spacer layer for separating a pair of diffractive gratings are rather well known in the art. Gerritsen et al in the same field of endeavor teaches to use an air gap as the spacer layer that interposed between a pair of refractive gratings. It would then have been obvious to one skilled in the art to apply the teachings of Gerritsen et al to use air layer as an alternative material for making the diffractive optical element for the benefit of providing an alternative design for the element. It also has been held it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

These references however do not teach explicitly that the peak portions and/or the valley portions of the pair of diffractive gratings are formed in a *chamfered shape*. Sakai et al in the same field of endeavor teaches a diffractive grating element with the *peak portion* and the *valley portion* of the grating being made of *chamfered shapes* such that it has *flat land region* (M) for the peak portion and *curved or tilted angle* (20) for the valley portion, (please see Figures 3(a) and 3(b)). Sakai et al teaches that by adjusting the size of the chamfered shapes, the pitch of the diffractive grating may be changed so that diffraction efficiency may be changed. It would then have been obvious to one skilled in the art to apply

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the teachings of Sakai et al to modify the diffractive optical element of Ishii to make the gratings have chamfered shapes for the peaks and/or valley portions for the benefit of changing the pitch of the gratings therefore changing the diffraction efficiency.

With regard to claim 13, Ishii teaches that the diffractive optical element (41) may be used with a lens (51) within an image pick-up system (60), (please see Figure 22).

With regard to claims 15-16, Ishii teaches that the optical regions may include optical material such as ultraviolet curable resin, (please see column 13, line 40). Although this reference does not teach explicitly that each pair of the diffractive gratings are made of such resin however it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With regard to claims 18 and 19, Sakai et al teaches explicitly that the region forming the chamfered shape is each formed with a flat surface (M) and a curved surface (20, Figure 3a). Although this reference does not teach explicitly about the claimed sizes for the chamfered regions however these modifications would have been obvious to one skilled in the art, for it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Response to Arguments

8. Applicant's arguments filed March 16, 2004 have been fully considered but they are not persuasive. The newly amended claims have been fully considered and they are rejected for the reasons stated above.

9. In response to applicant's arguments, which state that the cited Ishii reference teaches that "the different optical regions are arranged in contact with each other or close to each other" and the applicant submits that "in order to be able to be arranged as suggested, the different diffraction gratings positioned

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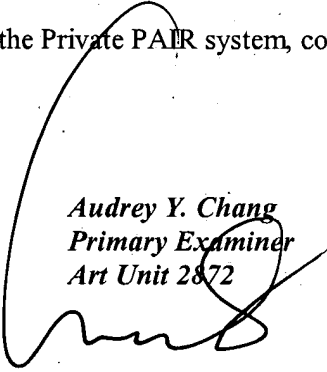
adjacent to each other would have the same grating thickness" (Remark pages 9-10), the examiner respectfully disagrees and wishes to indicate that this statement is wrong. The close contact between the two diffractive gratings DO NOT require them to have the same grating thickness. In fact Ishii teaches explicitly that the two diffractive gratings could have *different* depth or thickness (d_1 and d_2 , please see Figure 11 for the thickness values) and the gratings are in contact to each other as shown in Figure 8. Ishii et al also explicitly teaches that the thickness may be the same or may be different, (please see column 9, lines 60-67).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Audrey Y. Chang
Primary Examiner
Art Unit 2872



A. Chang, Ph.D.